

# Comparison of local absorption of core-shell nanoparticles with different core size and shell thickness

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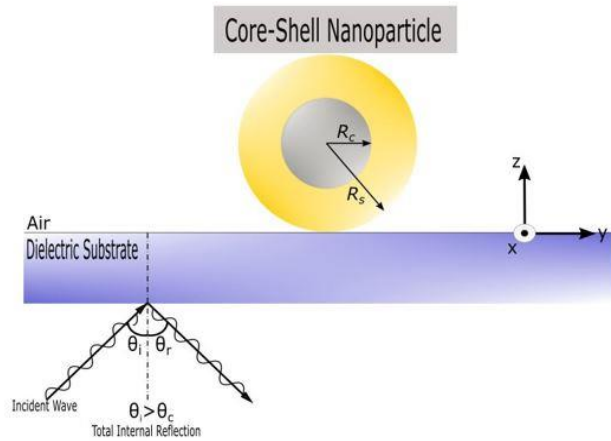
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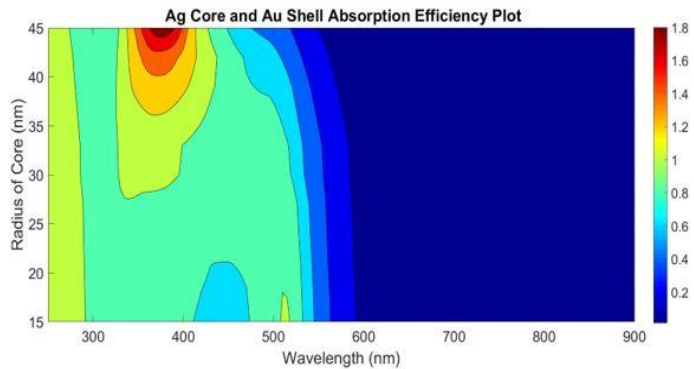
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The noble metals supporting surface plasmon polariton modes in the near-field regime introduced the possibility of utilizing surface plasmon resonance (SPR) of these materials in many applications. The spectral position of localized SPR of the nanoparticles depends on their size, shape, and surrounding medium. In some biomedical and sensing applications, optimum field enhancement is aimed; however, tuning the SPR position may not be guaranteed with single component nanoparticles due to impurities, and/or difficulties in creating certain shape and sizes. Hence, the idea of using alloys as well as different core and shell materials in nanoparticle compositions draw great interest [1]. The aim of using core-shell nanoparticle is to optimize the LSPR behavior of the particles with increasing field enhancement. Possible nanoparticle combinations can be considered as metal-metal, metal- dielectric, and dielectric-metal core-shell structures. Dielectric core and metal shell study showed that uniform field distribution can be achieved over the metal shell of the nanoparticles, and introducing an AFM tip results in near-field coupling with field enhancement [2].

In this study, we will focus on metal-metal core-shell nanoparticles with well-known noble metals such as gold, silver, and copper that are placed over dielectric substrate under surface evanescent illumination caused by total internal reflection. The variations of core and shell materials will be investigated with different core diameters and shell thicknesses to find an optimum size ratio, which is called as filling factor [3]. The aim is to provide a good insight for a selection of metal pairs regarding their effect on each other's absorption spectra. Tuning the plasmon resonance wavelength for chosen metal pairs will be further investigated with an AFM tip placed over the core-shell nanoparticle. For this purpose, the spectral absorption efficiency of the nanoparticles with different filling factors are determined using the discrete dipole approximation with surface interaction (DDA-SI).



**Figure 1** A cross-sectional schematic of the configuration.



**Figure 2** Absorption efficiency patterns for 50 nm diameter of silver-gold core-shell nanoparticle.

## References

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